

Character and History of the Yangtze Mud Wedge, Fujian Province

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LONG-TERM GOALS

To document and understand more completely the shallow marine geology, surface oceanography, and late Quaternary history of the southeast Asian continental margins, particularly in light of the large sediment fluxes from present-day rivers and sea-level fluctuations. Patterns of sediment transport, accumulation and remobilization play critical roles in the acoustic character of the seafloor, particularly as it relates to geoclutter.

OBJECTIVES

The purpose of this study was to document the nature of the innermost shelf in the southern East China and eastern South China seas, with particular interest in the fate of the Yangtze River sediment, which historically has discharged $\sim 500 \times 10^6$ t of sediment annually. Utilizing new geological and geophysical data, in FY 2004 we continued our investigation (in cooperation with our Chinese partners in Qingdao) of the major mud wedge that extends from the Yangtze River mouth southward along the Zhejiang and Fujian coastline into the Taiwan Strait.

APPROACH

In order to document the distribution and thickness of the Yangtze-derived mud, a high-resolution EdgeTech 0512i Chirp Sonar Subbottom Profiler has been used; grab sampler has been used for surface sampling; gravity and box corers have been used for coring. Seismic subbottom profiles have been post-processed using the Discover software at NCSU; Grain-size data has been analyzed using the Cilas Laser Particle Size Analyzer (model: 940L) in Qingdao; ^{210}Pb activities have also been tested at NCSU. The 2003 and 2004 cruises have been organized by Prof. Li Anchun from Inst. of Oceanology, Chinese Academy of Sciences, and Prof. Yang Zuosheng from Ocean University of China in Qingdao.

WORK COMPLETED

Our first cruise, conducted in late September 2003, obtained more than 600 km of high-resolution Chirp Sonar seismic data together with a number of shallow cores (Fig. 1 blue lines). Second cruise was just finished in late May 2004 with another 600 km Chirp Sonar seismic profiles (Fig. 1 red lines). Grain-size and heavy mineral analyses have already been done in Qingdao by Dave Velozzi,

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a graduate student of NCSU. ^{210}Pb activity and clay mineral are being tested at NCSU. Ten AMS ^{14}C dating have already been done in the NOSAMS lab of WHOI.

RESULTS

The seismic profiles reveal a huge clinoform deposit off the coast of Zhejiang and Fujian Provinces, with a thickest (~ 40 m) depocenter nearshore between the 20-30 m isobaths and progressively thins offshore (less than 100 km across the shelf) reaching water depths up to 60 to 70 meters in the ECS. However, this Yangtze-derived mud wedge has also been found to transport southward at least 800 km from the river mouth, extending all the way into the middle of the Taiwan Strait where it possibly meets the Taiwan rivers-derived hyperpycnal mudflow.

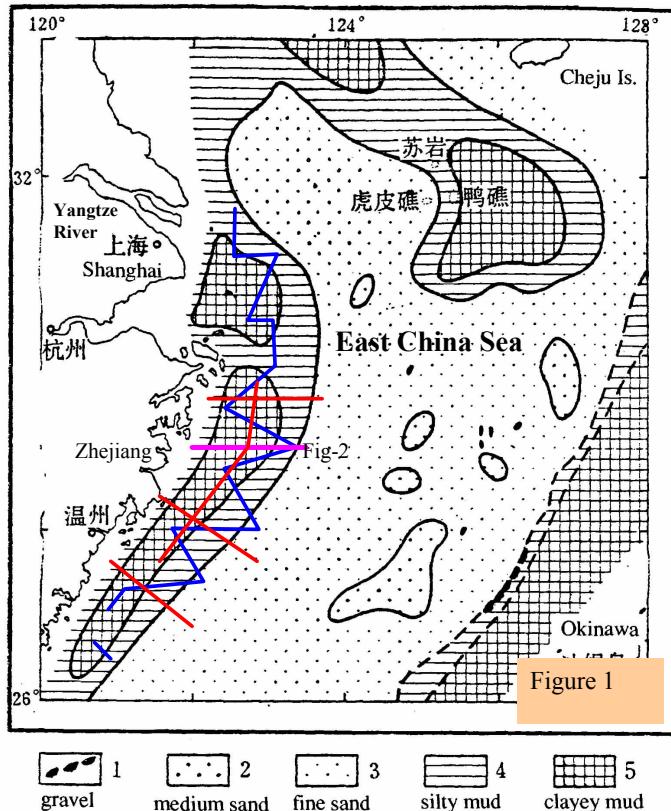


Figure 2

The total volume of this mud wedge is estimated to be about $1.2 \times 10^{12} \text{ m}^3$, which is about 1.4×10^{12} tons in total. Preliminary analysis of our seismic profiles and core data suggests that the Yangtze derived mud began to accumulate there only after the rapid sea-level rise of MWP-1B at around 11,000 yrs BP, when the sea level rose from -60 m to -40 m, together with the re-intensified Asian summer monsoon. But AMS C-14 dating suggest that major part of this mud has been transported southward along the shore since only about 7000 yrs BP by the newly formed Chinese coastal current after sea level reached its mid-Holocene highstand. This suggests that 2×10^8 tons of sediment could be discharged annually southward from the river to the inner shelf, mainly in the winter season, which equals to nearly 50% of the current annual Yangtze's sediment discharge. The

other half has been believed to be trapped in its estuary. The existing Taiwan Warm Current in the middle shelf and Kuroshio Current in the outer-middle shelf are also believed to play critical roles in blocking any Yangtze and Yellow-derived materials from being delivered further into the deep ocean.

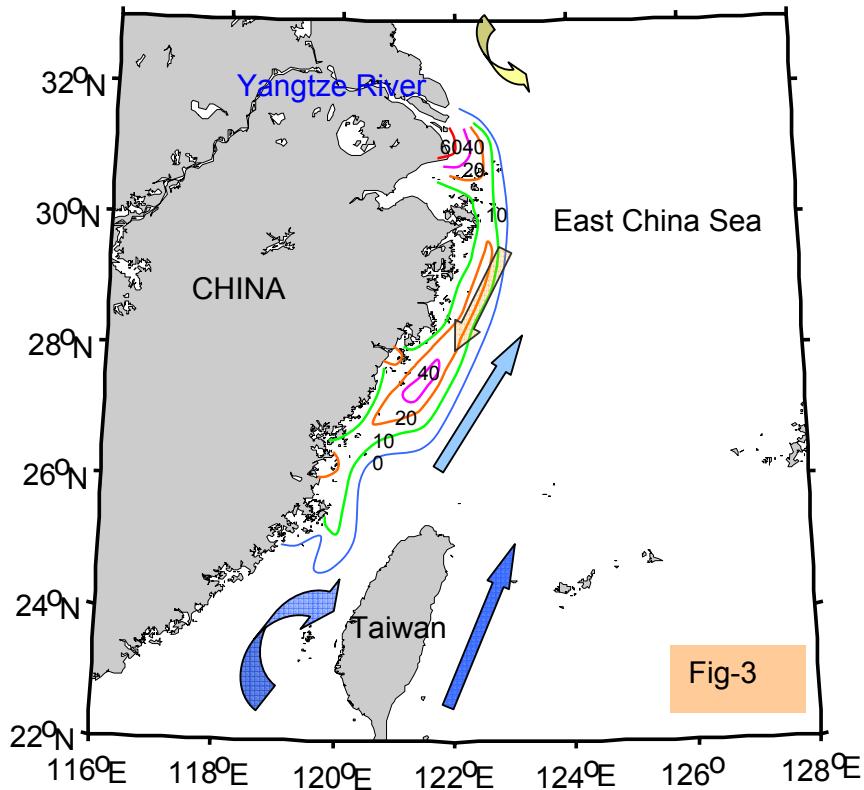


Fig.3 Holocene isopach of the Yangtze-derived mud deposits in the inner shelf of East China Sea

IMPACT/APPLICATIONS

Finding out the distribution, thickness, and history of the Yangtze mud deposits in the inner shelf of the ECS has the significant implications for us to understand the modern and historic sediment flux and fate from the land to ocean by a large river. Furthermore, it also help us to get a better understanding of the source-to-sink processes in this wide shallow epicontinental shelf. The sea-level change, monsoon variation and human activities may play roles in construction of the sequence of this thick clinoform deposit. Further studies will need and rich our interdisciplinary knowledge.

TRANSITIONS

None

RELATED PROJECTS

- Sediment Flux and Fate of the Yangtze River Sediments Delivered to the East China Sea. NSF, PI: Paul Liu
- Flux and fate of hyperpycnal fluvial discharge to the western Taiwan continental shelf. ONR, PI: John D. Milliman

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None

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PATENTS

None

HONORS/AWARDS/PRIZES

None